Ontario

Apprenticeship
In-school Curriculum Standards

Motorcycle Technician

Level 2

310G

Ministry of Training, Colleges and Universities

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TABLE OF CONTENTS

Introduction 2
Program Summary of Reportable Subjects 3

S0151 Engines 4
1.1 - Engines 5
1.2 - Exhaust Systems 9
1.3 - Cooling Systems 12
1.4 - Lubrication 15

S0152 Power Trains 18
2.1 - Drive Trains 19
2.2 - Final Drive 22

S0153 Brakes and Chassis 26
3.1 - Tires and Wheels 27
3.2 - Chassis 31
3.3 - Braking Systems 36

S0154 Electrical/Electronic and Fuel Systems 39
4.1 - Electrical System And Circuits 40
4.2 - Ignition Systems 44
4.3 - Electronic Fuel System 48
4.4 - Carbureted Fuel Systems 52

S0155 Work Practices 56
5.1 – Communications 57
5.2 – MIG And TIG Welding 60

Introduction

This new curriculum standard for the Motorcycle Technician trade is designed from the learning outcomes, which were developed from the industry-approved training standard.

The curriculum is organized into **2 levels** of training, each including reportable subjects containing learning outcomes to reflect the units of the training standard. The hours charts indicate how the curriculum can be delivered in the current block release format and summarizes the hours of training for each reportable by level. Since the reportable subjects are all divisible by three they can be adapted to accommodate a more flexible training delivery other than block release.

The reportable subjects are cross-referenced to the training standard for ease of comparison.

Each reportable subject and learning outcome identifies a recommended number of training hours. This hour allotment is broken into hours for instruction in theory and practical application. The division of the curriculum into reportable subjects follows a natural progression of learning through the training program. This structure will allow training centres and apprentices' flexibility in program delivery while still observing the importance of sequencing learning in a logical progression.

The curriculum is framed by and includes specific references to terminal performance objectives in the Apprenticeship Training Standards. However, the curriculum identifies only the learning that takes place off the job, in a training environment. The in-school program focuses primarily on the theoretical knowledge required to master the performance objectives of the Training Standards. Employers are expected to extend the apprentice's knowledge and skills through appropriate practical training on the work site. Regular evaluations of the apprentice's knowledge and skills are conducted throughout training to assure that all apprentices have achieved the learning outcomes identified in the curriculum standard. The balance between theoretical and practical evaluation is identified for each unit of learning outcomes.

Implementation date:

September, 2007

Program Summary of Reportable Subjects

Number	Reportable Subjects	Hours Total	Hours Theory	Hours Practical
S0151	Engines	48	26	22
S0152	Power Trains	37	24	13
S0153	Brakes and Chassis	50	32	18
S0154	Electrical/Electronic and Fuel Systems	72	48	24
S0155	Work Practices	33	25	8
	Total	**240**	**155**	**85**

Number:	S0151
Title:	**Engines**
Duration:	48 Total Hours
	Theory: 26 hours Practical: 22 hours
Prerequisites:	Level 1
Co-requisites:	Level 2 Reportable Subjects S0152, S0153, S0154 & S0155

Evaluation & Testing:

- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the eight-week term.
- Final exam at end of term.
- Periodic quizzes.

General Learning Outcome

Upon successful completion of this reportable subject, the apprentice is able to remove, diagnose, repair and install engines, including cooling, exhaust and lubrication systems in accordance with government safety regulations, manufacturer's recommendations/ specifications and approved industry standards.

Number: 1.1

Title: Engines

Duration: 23 Total Hours Theory: 13 hours Practical: 10 hours

Prerequisites: Level 1

Co-requisites: Level 2 Reportable Subjects S0152, S0153, S0154 & S0155

Cross-Reference to Training Standards: 4133.0 to 4133.28, 4133.31, 4134.0 to 4134.31, 4134.33, 4134.34, 4134.39

GENERAL LEARNING OUTCOME

Demonstrate a working knowledge of overhauling, testing, servicing and troubleshooting of motorcycle internal combustion engines.

LEARNING OUTCOMES

Upon successful completion, the apprentice is able to:

1.1.1 Demonstrate a theoretical understanding of engine removal and installation.

1.1.2 Describe the construction, principles of operation and repair procedures of 2 and 4 stroke cycle engine lower end assemblies.

1.1.3 Perform the dismantling, inspection, testing and reassembly of 2 and 4 stroke cycle engine lower end assemblies.

1.1.4 Describe the manufacturers' maintenance procedures, overhauling, reconditioning, failure analysis, troubleshooting, removal and installation practices for motorcycle engines using manufacturers' service literature.

Learning Content

1.1.1 Demonstrate a theoretical understanding of engine removal and installation. [4/0]

- disconnect wiring, control cables and fluid lines
- remove motor mounts, driveline components, intake and exhaust components
- frame protection during removal and installation
- installation of motor mounts, driveline components, exhaust and intake components
- connecting and routing of wiring, control cables and fluid lines
- adjustment of cables and bleeding of fluid lines

1.1.2 Describe the construction, principles of operation and repair procedures of 2 and 4 stroke cycle engine lower end assemblies. [7/0]

- connecting rod
  - reconditioning practices
    - testing straightness
    - testing twisting
    - big end bearings
    - rod thrust washer
    - small end busings
      - caged
      - uncaged
- crankshafts
  - 1 piece plain bearing type
    - inspection of oil galleries
    - inspection of journals
    - inspection of crank runout
    - bearing selection procedure
    - connecting rod selection
    - crankshaft journal and crankpin bearing types
    - primary drive
  - crankshaft balancer systems
    - crankshaft balance factors
    - counterweights
    - crankshaft anti-vibration systems

1.1.2

- assembled caged bearing type
  - crankshaft half sections
  - crank wheel attachment pins
  - interference fit of crank half sections
  - alignment of crank axis to counterweight
  - multiple journal phasing
  - main crankshaft bearings and seals
- main engine cases
  - horizontal and vertical split engine cases
  - crankcase pressure testing
  - noise diagnosis

1.1.3 Perform the dismantling, inspection, testing and reassembly of 2 and 4 stroke cycle engine lower end assemblies.
[0/10]

- assembled roller bearing type crankshaft
  - inspect condition of crankshaft wheels
  - condition of crank pin, rod, bearing
  - check interference fit on crank wheels
  - overhaul and align crank wheels
  - inspection for multiple journal phasing
  - rebuild crankshaft using press, align
  - main crankshaft bearings and seals
    - inspection, removal, sizing and installation
  - thrust washers
- one piece plain bearing type crankshaft
  - measure crank pin and journal O.D.
  - measure connecting rod big end and crankcase I.D
  - measure crankshaft main and rod bearing clearance
  - check crankshaft thrust endplay
  - inspect crankshaft main and connecting rod big end bearings
- crankcase
  - disassembly, inspection and re-assembly
  - check for warpage / distortion
  - inspection of threads
  - cleaning procedure of cases
  - bearing seating procedures
  - horizontal and vertical split engine cases

1.1.4 Describe the manufacturers' maintenance procedures, overhauling, reconditioning, failure analysis, troubleshooting, removal and installation practices for motorcycle engines using manufacturers' service literature.
[2/0]

- bearing sizings
- gaskets
- seals
- engine performance testing
- dynamometer test procedures
- applied safety precautions
  - eye, hand, hearing and face protection
  - solvents
  - hoists and lifts
- applied tools and equipment
  - special tools for engine overhaul
  - dial indicator
  - reamers
  - installers and pullers
  - surface plate
  - bore gauge
  - hydraulic press
  - V-blocks
  - crankshaft truing and pressing equipment
  - boring bar
  - hones

Number:	1.2		
Title:	Exhaust Systems		
Duration:	8 Total Hours	Theory: 5 hours	Practical: 3 hours
Prerequisites:	Level 1		
Co-requisites:	Level 2 Reportable Subjects S0152, S0153, S0154 & S0155		

Cross-Reference to Training Standards: 4138.0, 4138.02 to 05

GENERAL LEARNING OUTCOMES

Develop an understanding of definitions and applied fundamentals of motorcycle exhaust systems.

LEARNING OUTCOMES

Upon successful completion, the apprentice is able to:

1.2.1 Explain the history, purpose, types, functions and applications of motorcycle exhaust systems.

1.2.2 Describe the construction and principles of operation of motorcycle exhaust systems.

1.2.3 Perform troubleshooting, failure analysis and repair practices of motorcycle exhaust systems.

1.2.4 Describe and demonstrate manufacturers' testing and maintenance procedures for diagnosing exhaust systems using prescribed service literature.

1.2.1 Explain the history, purpose, types, functions and applications of motorcycle exhaust systems.
[1/0]

- design fundamentals
  - 4 stroke cycle
  - 2 stroke cycle

1.2.2 Describe the construction and principles of operation of motorcycle exhaust systems.
[2/0]

- exhaust system design
  - header pipes
  - tuned exhaust systems
  - 4 stroke cycle exhaust control valves
  - collector chambers
  - emissions standards
  - oxygen sensors
  - catalytic converters
  - air injection systems
  - resonation
- silencing principle
  - muffling devices
- materials used in construction
  - stainless steel
  - mild steel
  - cast iron
  - aluminum
  - carbon fibre
  - fibreglass
  - titanium

1.2.3 Perform troubleshooting, failure analysis and repair practices of motorcycle exhaust systems.
[2/2]

- exhaust leak detection
- restriction effects (back pressure)
- design and configuration of exhaust to engine requirements
- exhaust gas analyzer

1.2.4 Describe and demonstrate manufacturers' testing and maintenance procedures for diagnosing exhaust systems using prescribed service literature
[0/1]

- exhaust gas analyzer
- temperature monitoring device (oil)
- applied safety precautions
  - eye, hand, face and hearing protection
  - solvents
  - hoists and stands
- applied tools and equipment
  - manufacturers' special service tools

Number	1.3		
Title:	Cooling Systems		
Duration:	8 Total Hours	Theory: 4 hours	Practical: 4 hours
Prerequisites:	Level 1		
Co-requisites:	Level 2 Reportable Subjects S0152, S0153, S0154 & S0155		

Cross-Reference to Training Standards: 4137.0 to 4137.08

GENERAL LEARNING OUTCOME

Demonstrate a working knowledge of the definitions and applied fundamentals of motorcycle cooling systems

LEARNING OUTCOMES

Upon successful completion, the apprentice is able to:

1.3.1 Describe the construction and principles of operation of motorcycle internal combustion engine cooling systems.

1.3.2 Dismantle, inspect, test and reassemble lubricating cooling system components with the prescribed service tools and equipment.

Learning Content

1.3.1 Describe the construction and principles of operation of motorcycle internal combustion engine cooling systems.
[3/1]

- air cooling systems
  - methods of heat transfer
  - ducting
- oil/air cooling systems
  - oil cooling circuitry
  - heat exchangers
- liquid cooling systems
  - circuitry
  - carburettor heater
  - coolant pumps
  - thermostats
  - radiator caps
  - coolant recovery tank
  - characteristics of antifreeze
  - characteristics of sealed cooling system
  - mixing ratios
  - heat exchanger
    - cooling fan systems

1.3.2 Dismantle, inspect, test and reassemble lubricating cooling system components with the prescribed service tools and equipment.
[1/3]

- air cooling systems
  - clean and inspect cooling fins
- oil/air coolant systems
  - leak detection
- liquid cooling systems
  - pressure test
  - rad cap pressure and vacuum test
  - thermostat temperature opening test
  - cooling lines and hoses
  - coolant pump and seals
  - test specific gravity and PH level of coolant mixture
  - air purging of cooling system
- applied safety precautions
  - radiator cap removal safety
    - eye, face and hand protection

1.3.2

- hoists and stands
- solvents
- environmentally safe disposal of used coolant
- hot coolant hazards

• applied tools and equipment
- hydrometers
- manufacturers' special service tools
    - hydrostatic test equipment

Number:	1.4		
Title:	Lubrication		
Duration:	9 Total Hours	Theory: 4 hours	Practical: 5 hours
Prerequisites:	Level 1		
Co-requisites:	Level 2 Reportable Subjects S0152, S0153, S0154 & S0155		

Cross-Reference to Training Standards: 4133.0, 4134.0

GENERAL LEARNING OUTCOME

Demonstrate a working knowledge of the definitions and applied fundamentals of motorcycle lubrication.

LEARNING OUTCOMES

Upon successful completion, the apprentice is able to:

1.4.1 Describe manufacturers' maintenance procedures for lubrication circuits and perform assigned operations.

1.4.2 Dismantle, inspect, test and reassemble lubricating circuit with the prescribed service tools and equipment.

Learning Content

1.4.1 Describe manufacturers' maintenance procedures for lubrication circuits and perform assigned operations.
[4/0]

- 4 stroke cycle lubricating circuit
  - pressure test system
  - visual inspection of oil
  - pressure bypass valve
  - clean/replace filter
  - sump screens
  - magnetic drain plug
  - seals and rings
  - disassemble/reassemble pump
  - crankcase ventilation systems
- 2 stroke cycle lubricating circuit
  - interpret lubrication circuit schematics
- Society of Automotive Engineers viscosity classification
- American Petroleum Institute quality grades

1.4.2 Dismantle, inspect, test and reassemble lubricating circuit with the prescribed service tools and equipment.
[0/5]

- 4 stroke cycle lubricating circuit
  - pressure test system
  - visual inspection of oil
  - pressure bypass valve
  - clean/replace filter
  - sump screen
  - magnetic drain plug
  - inspect seals and rings
  - disassemble/reassemble pump
  - inspect oil gallery circuitry
  - crankcase ventilation systems
- 2 stroke cycle lubricating circuit
  - adjust oil pump settings
  - oil pump drive mechanisms
  - oil tank filters, hoses, warning light operation
  - oil tank venting
  - routing of hoses and passageways
  - interpret oil / lubrication circuit schematics
  - oil pump output test
  - bleeding lubrication circuit

1.4.2

- applied safety precautions
  - eye, face and hand protection
  - hoists and stands
  - solvents
  - environmentally safe disposal of used lubricants
  - hot lubricant hazards
- applied tools and equipment
  - pressure gauges
  - manufacturers' special service tools

Number:	S0152
Title:	**Power Trains**
Duration:	37 Total Hours
	Theory: 24 hours Practical: 13 hours
Prerequisites:	Level 1
Co-requisites:	Level 2 Reportable Subjects S0151, S0153, S0154 & S0155

Evaluation & Testing:

- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the eight-week term.
- Final exam at end of term.
- Periodic quizzes.

GENERAL LEARNING OUTCOMES

Upon successful completion of this reportable subject, the apprentice is able to remove, diagnose, repair and install variable ratio belt drive system and final drive units, in accordance with government safety regulations, manufacturer's recommendations/ specifications and approved industry standards.

Number:	2.1		
Title:	Drive Trains		
Duration:	9 Total Hours	Theory: 6 hours	Practical: 3 hours
Prerequisites:	Level 1		
Co-requisites:	Level 2 Reportable Subjects S0151, S0153, S0154 & S0155		

Cross-Reference to Training Standards: 4139.0

GENERAL LEARNING OUTCOMES

Demonstrate a working knowledge of motorcycle variable ratio belt drives.

LEARNING OUTCOMES

Upon successful completion, the apprentice is able to:

2.1.1 Describe the history, purpose, function, types and application of motorcycle variable ratio belt drives.

2.1.2 Describe the construction and principles of operation of motorcycle variable ratio belt drives.

2.1.3 Perform the dismantling, inspection, testing and reassembly procedures of motorcycle variable ratio belt drives.

Learning Content

2.1.1 Describe the history, purpose, function, types and application of motorcycle variable ratio belt drives.
[2/0]

- fundamentals
- variable ratio belt drive
  - sheaves
    - primary
    - secondary
  - torque feedback cams
  - idlers
  - electronic ratio control
  - belts
  - springs
  - weights
    - spider assembly

2.1.2 Describe the construction and principles of operation of motorcycle variable ratio belt drives.
[4/0]

- variable ratio belt drive
  - sheaves
    - primary
    - secondary
  - torque feedback cams
  - idlers
  - belts
  - springs
  - dynamic forces
  - centrifugal force
  - leverage and mechanical force
  - electronic ratio control

2.1.3 Perform the dismantling, inspection, testing and reassembly procedures of motorcycle variable ratio belt drives.
[0/3]

- variable ratio belt drive
  - sheaves
    - primary
    - secondary
  - torque feedback cams

2.1.3

- idlers
- belts
- springs
- electronic ratio control

- applied safety precautions
  - eye and hand protection
  - hoists and stands
  - solvents
- applied tools and equipment
  - manufacturers' special service tools
  - pullers
  - holding devices
  - measuring devices
  - tension gauges

Number: 2.2

Title: Final Drive

Duration: 28 Total Hours Theory: 18 hours Practical: 10 hours

Prerequisites: Level 1

Co-requisites: Level 2, Reportable Subjects S0151, S0153, S0154 & S0155

Cross-Reference to Training Standards: 4139.0, 4139.18 to 4139.23

GENERAL LEARNING OUTCOMES

Demonstrate a working knowledge of motorcycle final drive units.

LEARNING OUTCOMES

Upon successful completion, the apprentice is able to:

2.2.1 Describe the history, purpose, function, types and application of motorcycle final drive.

2.2.2 Describe the construction and principles of operation of motorcycle final drive.

2.2.3 Perform the dismantling, inspection, testing and reassembly of motorcycle final drive.

2.2.4 Describe and demonstrate manufacturers' testing and maintenance procedures for motorcycle final drive.

Learning Content:

2.2.1 Describe the history, purpose, function, types and application of motorcycle final drive.
[4/0]

- fundamentals enhancement
  - gear train types
  - gear types
  - ratio
  - torque
  - power flow
- fundamentals
  - chain drive
  - belt drive
  - shaft drive

2.2.2 Describe the construction and principles of operation of motorcycle final drive.
[10/0]

- chain drives
  - chains
    - sizing
    - master links
  - sprockets
  - sprocket dampening systems
- belt drive
  - belt types
  - materials
  - tooth style/pitch
  - design
  - size
  - toothed pulleys
- shaft drive
  - secondary drive unit
    - dampener
    - gear assembly
    - bevelled gears
  - drive shafts
    - universal joint
    - constant velocity joint
    - shafts
    - dampeners
    - spline joints

2.2.2

- final gear assembly
  - case
  - bearings
  - bevelled gear assembly
  - spline joints
  - rear wheel spline dampener
  - spiral gear assemblies
  - hypoid gear assemblies
  - bevel gear assembly
- noise diagnosis

2.2.3 Perform the dismantling, inspection, testing and reassembly of motorcycle final drive.
[2/8]

- chain drive
  - inspection for chain and sprocket wear/damage
  - alignment
  - dampening assemblies
  - adjust chain tension
- belt drives
  - visual inspection for wear of belt and toothed pulleys
  - alignment and belt tension adjustment
  - wear patterns
  - dampening assemblies
- shaft drive
  - secondary drive unit
    - shimming
    - tooth contact pattern
    - backlash
    - adjust pre-load on bearings
    - dampening assembly
    - gear tooth condition
    - inspect and renew seals
    - reassemble secondary drive unit
    - inspect vent circuit
  - drive shaft
    - remove driveshaft from swingarm and check shaft run-out and twist
    - inspect dampening mechanism
    - inspect condition of universal joints
    - clean, inspect and lubricate splines
    - reassemble driveshaft to swingarm
    - check driveshaft runout

2.2.3

- final drive unit
  - disassemble and select shims according to gear backlash and tooth contact pattern
  - adjust pre-load on bearings
  - inspect condition of rear wheel dampening assembly, gear tooth condition, vent circuit
  - inspect and renew seals
  - inspect condition of rear wheel and driveshaft connection splines

2.2.4 Describe and demonstrate manufacturers' testing and maintenance procedures for motorcycle final drive.
[2/2]

- backlash and gear tooth contact
  - pre-load adjustments
  - machinists' paste
- lubrication
  - gear lubes
  - greases
  - extreme pressure lubes
- tempered steel identification
- shim selection using manufacturers' numbering system
- safety precautions
  - exposed rotating component precautions
  - eye and hand protection
  - hoists and stands
  - solvents
- applied tools and equipment
  - precision measuring tools
  - manufacturers' special service tools
  - machinists' paste
  - pullers

Number:	S0153
Title:	**Brakes And Chassis**
Duration:	50 Total Hours
	Theory: 32 hours Practical: 18 hours
Prerequisites:	Level 1
Co-requisites:	Level 2 Reportable Subjects S0151, S0152, S0154 & S0155

Evaluation & Testing:

- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the eight-week term.
- Final exam at end of term.
- Periodic quizzes.

GENERAL LEARNING OUTCOMES

Upon successful completion of this reportable subject, the apprentice is able to remove, diagnose, repair and install tires and wheels, chassis components and braking systems in accordance with government safety regulations, manufacturer's recommendations/ specifications and approved industry standards.

Number:	3.1
Title:	Tires And Wheels
Duration:	16 Total Hours Theory: 10 hours Practical: 6 hours
Prerequisites:	Level 1
Co-requisites:	Level 2, Reportable Subjects S0151, S0152, S0154 & S0155

Cross-Reference to Training Standards: 4145.0 to 4145.09

GENERAL LEARNING OUTCOMES

Demonstrate a working knowledge of motorcycle tires, wheels and rims.

LEARNING OUTCOMES

Upon successful completion, the apprentice is able to:

3.1.1 Describe the history, purpose, functions, types and application of motorcycle tires, wheels and rims.

3.1.2 Describe the construction and principles of operation of motorcycle tires, wheels and rims.

3.1.3 Demonstrate the dismantling, inspection, testing and reassembly of motorcycle tires, wheels and rims.

3.1.4 Describe the manufacturers' testing and maintenance procedures for motorcycle tires, wheels and rims.

Learning Content

3.1.1 Describe the history, purpose, functions, types and application of motorcycle tires, wheels and rims.
[1/0]

- fundamentals
  - terminology
  - ratings
  - sizing
  - load capacities
  - construction
  - wheel type
  - application

3.1.2 Describe the construction and principles of operation of motorcycle tires, wheels and rims.
[8/0]

- tires
  - application and design
  - construction characteristics
    - bias ply
    - radial
    - belted
    - tubed
    - tubeless
    - inner tubes
    - tread designs
    - rolling radius
  - speed and load ratings
  - sizing
    - Imperial
    - metric
    - alpha-numeric
  - balancing
    - static
    - dynamic
  - tread wear patterns
- wheels
  - cast
  - pressed
  - spoked
  - rim design
  - tubed / tubeless rims

3.1.2

- rim composition
- bearing types
- wheel mounting
  - brakes
  - sprockets
- conical hubs
- symmetrical hubs
- spoke lacing patterns
  - offset
    - radial runout
    - lateral runout

3.1.3 Demonstrate the dismantling, inspection, testing and reassembly of motorcycle tires, wheels and rims.
[0/6]

- tires
  - size and condition (interior / exterior)
  - proper mounting procedure
  - proper balancing procedure
  - inspection of tread / sidewall
  - tire run out
  - manufacturers' tire repair recommendations
    - plug/patch
    - sealants
  - balancing
    - static
    - dynamic
  - tire maintenance
  - tubes
    - rimlocks
    - rimband
  - storage
  - disposal
- wheel assemblies
  - run-out checks
    - damage
    - fatigue
    - corrosion
    - discolouration
  - lace and true spoke type wheels
    - spokes
    - hubs
    - rims

3.1.3

- bearings
  - seals
  - preload
  - inspection
  - replacement procedures
- remove/install wheel assembly

3.1.4 Describe the manufacturers' testing and maintenance procedures for motorcycle tires, wheels and rims.
[1/0]

- inflation pressures
- dyno testing precautions
- applied safety precautions
  - eye, hand and face protection
  - hoists and stands
  - solvents/cleaners
- applied tools and equipment
  - balancers
  - wheel truing jigs
  - spoke wrenches
  - bearing drivers
  - pressure gauges
  - tire seating materials
  - tire mounting equipment
  - tire tread depth gauge

Number: 3.2

Title: Chassis

Duration: 16 Total Hours Theory: 10 hours Practical: 6 hours

Prerequisites: Level 1

Co-requisites: Level 2 Reportable Subjects S0151,S0152,S0154 & S0155

Cross-Reference to Training Standards: 4140.0 to 4140.07, 4141.0 to 4141.07, 4142.0 to 4142.08, 4151.0 to 4151.06, 4152.0 to 4152.05

GENERAL LEARNING OUTCOMES

Demonstrate a working knowledge of the repair, diagnosis and failure analysis practices of motorcycle chassis systems.

LEARNING OUTCOMES

Upon successful completion, the apprentice is able to:

3.2.1 Describe the history, purpose, function, types and application of motorcycle chassis.

3.2.2 Develop a theoretical understanding of the diagnostic and failure analysis practices of motorcycle chassis systems.

3.2.3 Perform inspection, diagnostics and failure analysis on frame and chassis systems.

3.2.4 Describe manufacturers' testing and maintenance procedures for motorcycle chassis systems.

Learning Content:

3.2.1 Describe the history, purpose, function, types and application of motorcycle chassis.
[1/0]

- fundamentals enhancement

3.2.2 Develop a theoretical understanding of the diagnostic and failure analysis practices of motorcycle chassis systems.
[8/0]

- front suspension
  - factors affecting motorcycle stability
    - rake
    - trail
    - centre of gravity
    - tire contact patch
    - accessory mounting
    - weight distribution
    - mounting and condition of components
      - worn
      - damaged
    - integrity of assembly
    - wheel alignment
    - trailer towing
    - environmental effects
    - adjustment procedures
      - fork oil quantity
      - air pressure
      - spring rate
      - dampening
      - spring pre-load
    - suspension tuning principles
- rear suspension
  - dampening
  - spring pre-load
  - gas/air charging (pneumatic)
  - shock absorber pressurization
  - spring rate
  - pivot points
  - swingarm suspension
  - suspension tuning principles
- steering mechanism
  - steering head bearing adjustment

3.2.2

- steering dampers
- operation of
  - bearings
  - seals
  - retainers

- bodywork
  - modifications and alterations
  - stress cracks
  - alignment alterations
- frames
  - damage
  - stress cracking
  - welding joints
  - torquing of engine fasteners to frame
  - mounting points and attachments
  - alignment
  - accessory mounts inspection
  - sidecars
    - tow-in
    - tow-out
    - wheel lead
    - relationship of camber angle
    - handling characteristics of sidecar motorcycles

3.2.3 Perform inspection, diagnostics and failure analysis on frame and chassis systems [0/6]

- factors affecting motorcycle stability
  - tire pressure
  - wheel alignment
  - tire sizing
  - tire types
  - trueness of rims and tires
  - wheel bearing
  - worn suspension components
  - loose frame bolts
  - maladjustments
  - effects of attachments and incompatible accessories on aerodynamics
  - swingarm attachment points
  - general alignment
  - spoke tension
  - spoke condition
  - seating positions
  - handlebar positions
  - weight distribution

3.2.3

- front suspension
  - fork bushings
  - damper oil flow characteristics
  - telescopic shock suspension, disassembly/reassembly procedures
  - anti-dive mechanisms - inspect operation
    - electric
    - mechanical
    - hydraulic
- rear suspension
  - swingarm bearing/bushing inspection and replacement
  - spring free lengths
  - pressurized shock absorbers
  - alignment of swingarm linkage
  - draining and refilling of fluids
- steering mechanism
  - steering head bearings - inspect condition, replace
  - steering damper – mounting and operation
  - handlebar controls
    - mounts
    - end weights
    - bushings
    - steering apparatus (set-up)
    - steering stops
- bodyworks
  - inspect for cracks and deformation
- frames
  - non-structural repairs
  - welding practices (approved)
  - straightening practices
  - accident-related damage

3.2.4 Describe manufacturers' testing and maintenance procedures for motorcycle chassis systems.
[1/0]

- nitrogen refilling apparatus
- alignment tools
  - straight edge
  - torque wrench
  - plumb line
  - spring scales
- applied safety precautions
  - eye, hand, hearing and face protection
  - hoists and stands
  - solvents

3.2.4

- effects of chemicals on body finishes
- platings and coatings precautions

- applied tools and equipment
  - manufacturers' special service tools
  - precision measuring tools
  - straightedge, plumb line, spring scales
  - pullers
  - bearing drivers
  - seal drivers
  - hoists and stands

Number:	3.3
Title:	Braking Systems
Duration:	18 Total Hours Theory: 12 hours Practical: 6 hours
Prerequisites:	Level 1
Co-requisites:	Level 2 Reportable Subjects S0151, S0152, S0154 & S0155

Cross-Reference to Training Standards: 4143.0, 4144.0, 4144.07, 4144.08

GENERAL LEARNING OUTCOMES

Demonstrate a working knowledge of motorcycle braking systems.

LEARNING OUTCOMES

Upon successful completion, the apprentice is able to:

3.3.1 Describe the history, purpose, function, types and application of motorcycle braking systems.

3.3.2 Describe the construction and principles of operation of motorcycle anti-lock and linked braking systems.

3.3.3 Dismantle, inspect, test and reassemble anti-lock and linked braking systems, as per manufacturers' procedures.

Learning Content:

3.3.1 Describe the history, purpose, function, types and application of motorcycle braking systems.
[4/0]

- basic hydraulic theory
- hydraulic linked braking system
- anti-lock braking systems

3.3.2 Describe the construction and principles of operation of motorcycle anti-lock and linked braking systems.
[8/0]

- velocity and deceleration rate
- hydraulics
- electronic control
- performance/advantage
- Anti-lock Braking Systems
  - master cylinder
  - electric pump and accumulator
  - valve body assembly
  - electronic controller
  - wheel sensors
  - single or multi-channel
  - self check system
- Linked Braking Systems
  - caliper design
  - metering valve
  - proportional control valve
  - secondary master cylinder

3.3.3 Dismantle, inspect, test and reassemble anti-lock and linked braking systems, as per manufacturers' procedures.
[0/6]

- visual inspection
  - lines
  - pads
  - leakage
  - wiring/connectors
- bleeding procedures
- fault codes
- sensors
- actuators

3.3.3

- hydraulic pressure precautions
- applied safety precautions
  - eye, hand and breathing protection
  - ventilation
  - hoists and stands
  - solvents
- applied tools and equipment
  - storage of brake fluids
  - precision measuring tools
  - dial indicators
  - manufacturers' special service tools
  - pullers
  - holding devices

Number:	S0154
Title:	**Electrical/Electronic And Fuel Systems**
Duration:	72 Total Hours
	Theory: 48 hours Practical: 24 hours
Prerequisites:	Level 1
Co-requisites:	Level 2 Reportable Subjects S0151, S0152, S0153 & S0155

Evaluation & Testing:

- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the eight-week term.
- Final exam at end of term.
- Periodic quizzes.

General Learning Outcome

Upon successful completion of this reportable subject, the apprentice is able to test, diagnose and repair electrical and ignition systems using manufacturer's guidelines and schematics in addition the apprentice will also competently test and repair carbureted and electronic fuel control systems in accordance with government safety regulations, manufacturer's recommendations/ specifications and approved industry standards.

Number: 4.1

Title: Electrical Systems & Circuits

Duration: 12 Total Hours Theory: 8 hours Practical: 4 hours

Prerequisites: Level 1

Co-requisites: Level 2 Reportable Subjects S0151, S0152, S0153 & S0155

Cross-Reference to Training Standards: 4147.0, 4149.0 to 4149.07

GENERAL LEARNING OUTCOMES

Demonstrate a working knowledge of motorcycle electrical systems and circuits.

LEARNING OUTCOMES

Upon successful completion, the apprentice is able to:

4.1.1 Describe the history, purpose, function, types and application of motorcycle electrical systems and circuits.

4.1.2 Define the construction and principles of operation of motorcycle electrical systems and circuits.

4.1.3 Perform the testing, diagnosis, overhaul and repair of motorcycle electrical systems and circuits.

4.1.4 Describe manufacturers' testing and maintenance procedures for motorcycle electrical systems and circuits

Learning Content

4.1.1 Describe the history, purpose, function, types and application of motorcycle electrical systems and circuits.
[2/0]

- fundamentals enhancement
  - basic electricity
  - magnetism
  - Ohm's Law
  - electromagnetic induction
  - basic electronics
  - static electricity
  - AC/DC
  - lead-acid batteries

4.1.2 Describe the construction and principles of operation of motorcycle electrical systems and circuits.
[5/0]

- starting system
  - starter motors
    - parallel wound
    - permanent magnet
    - brushes
  - starter relay
  - starter switch
  - safety interlock relays, switches and lights
  - decompression systems
  - safety interlock systems
  - relays, switches, lights
  - starter cut out relay
  - starter solenoid
    - pull-in windings
    - hold-in windings
    - starter relay
  - starter drives
    - Bendix
    - sprag and roller type one-way clutch
    - gear reduction
- lighting and accessory circuits
  - light operation
  - horn
  - instrumentation
  - switches

4.1.2

- reserve lighting unit
- turn signals
- brake lights
- radio / tape player / CB
- tachometer
- speedometer
- fuel / temperature gauges
- cruise control
- instrument lights
- sender units
- air pumps
- warning lights
- suspension control system
- anti-lock braking systems

4.1.3 Perform testing, diagnosis, overhaul and repair of motorcycle electrical systems and circuits.
[0/4]

- starter system
  - starter load test (current)
  - voltage drop test
  - starter relay resistance
  - starter cut-out relay resistance
  - switch resistance / continuity
  - inspect starter drive mechanisms
  - inspect internal components of starter motor
- lighting and accessory circuits
  - resistance tests
  - current draw
  - peak voltage output

4.1.4 Describe manufacturers' testing and maintenance procedures for motorcycle electrical systems and circuits.
[1/0]

- sequential troubleshooting techniques
- diagnostic flow charts
- applied safety precautions
  - eye, hand and face protection
  - solvents
  - hoists and stands
  - battery precautions

4.1.4

- applied tools and equipment
  - dial gauge
  - proprietary test equipment
  - low Ohm's resistance tester
  - manufacturers' special service tools
  - pullers
  - digital and analog multimeters
  - scan tools

Number:	4.2
Title:	Ignition Systems
Duration:	16 Total Hours Theory: 11 hours Practical: 5 hours
Prerequisites:	Level 1
Co-requisites:	Level 2 Reportable Subjects S0151, S0152, S0153 & S0155

Cross-Reference to Training Standards: 4148.0 to 4148.15

GENERAL LEARNING OUTCOME

Demonstrate a working knowledge of motorcycle ignition systems.

LEARNING OUTCOMES

Upon successful completion, the apprentice is able to:

4.2.1 Describe the history, function, purpose, function and types of ignition systems

4.2.2 Describe the construction and principles of operation of motorcycle ignition systems.

4.2.3 Perform the testing, diagnosis, overhaul and repair of motorcycle ignition systems.

4.2.4 Describe manufacturers' testing and maintenance procedures for motorcycle ignition systems.

Learning Content

4.2.1 Describe the history, function, purpose, function and types of ignition systems.
[1/0]

- contact breaker point systems
  - magneto
  - battery
- capacitor discharge ignition
  - A/C powered
  - D/C powered
- transistor ignition
  - analog
  - digital
- spark plugs
  - types
  - styles
- ignition system interlocks

4.2.2 Describe the construction and principles of operation of motorcycle ignition systems.
[8/0]

- points
  - battery and coil ignition systems
  - point self energizing ignition systems
  - contact breaker points
  - condenser
  - permanent magnet rotor
  - ignition coil/ high tension lead/spark plug cap
  - primary/secondary windings
  - ignition switch
  - emergency stop switch
  - spark plug
  - ignition advance / retard mechanisms
  - voltage available
  - required voltage
  - reserved voltage
  - power source
    - flywheel magneto (primary coil)
    - battery
- capacitor discharge ignition
  - power source AC/DC
  - permanent magnet rotor
  - capacitor charging coil

4.2.2

- trigger / pulsar coil
- igniter box
  - DC → DC Converter
  - thyristor
  - wave shaping circuit
  - capacitor
- switches/start-run circuit
- ignition coil/ high tension lead/spark plug cap
- spark plugs
- heat range
- ignition curve
- advantage of digital over analog
- ignition advance
  - gear position sensor
  - voltage available
  - required voltage
  - reserve voltage

• transistorized ignition
- analog
- digital
- power source
- reluctor
- igniter box
- spark plug
- ignition coil/high tension lead
- direct ignition coil
- switches
- crank position sensor
- voltage available
- required voltage
- reserve voltage
- timing advance methods
- trigger/pulser coil

4.2.3 Perform the testing, diagnosis, overhaul and repair of motorcycle ignition systems. [0 /5]

• ignition
- ignition coil testing
  - resistance test
  - spark air gap test
- timing test
  - ignition curve
- spark plug cap resistance

4.2.3

- meter types
- throttle position sensor
- indexing of ignition marks
- power source test
- trigger/pulser coil test
- igniter box test

4.2.4 Describe manufacturers' testing and maintenance procedures for motorcycle ignition systems.
[2/0]

- sequential troubleshooting techniques
- electronic diagnostic flow charts
- diagnostic system analyzers
- applied safety precautions
  - eye, hand and face protection
  - solvents
  - hoists and stands
  - battery precautions
- applied tools and equipment
  - timing light
  - dial gauge
  - proprietary test equipment
  - low Ohm's resistance tester
  - spark plug cap tester
  - manufacturers' special service tools
  - pullers
  - digital and analog multimeters
  - peak voltage adapters

Number: 4.3

Title: Electronic Fuel Systems

Duration: 28 Total Hours Theory: 20 hours Practical: 8 hours

Prerequisites: Level 1

Co-requisites: Level 2 Reportable Subjects S0151, S0152, S0153 & S0155

Cross-Reference to Training Standards: 4136.0 to 4136.15

GENERAL LEARNING OUTCOMES

Demonstrate a working knowledge of motorcycle electronic fuel systems.

LEARNING OUTCOMES

Upon successful completion, the apprentice is able to:

4.3.1 Describe the history, function, purpose, types and applications of motorcycle electronic fuel systems

4.3.2 Describe the construction and principles of operation of motorcycle electronic fuel systems.

4.3.3 Perform the dismantling, inspection, testing and reassembly of motorcycle electronic fuel systems.

4.3.4 Describe manufacturers' testing and maintenance procedures for motorcycle electronic fuel systems.

Learning Content

4.3.1 Describe the history, function, purpose, types and applications of motorcycle electronic fuel systems
[2/0]

- system overview
- electronic circuit
  - electronic control unit (ECU)
  - sensors
  - central processing unit (CPU)

4.3.2 Describe the construction and principles of operation of motorcycle electronic fuel systems.
[16/0]

- air intake circuit layout
  - air box
  - pressurized air box
  - air filter
  - throttle body
    - secondary throttle valves
  - intake manifold
- fuel system
  - tank
  - pump (high pressure)
    - vane
    - rotary
  - fuel lines/connector
  - fuel distribution rail
  - fuel pressure regulator
    - external
    - internal
  - injector
  - injector sealing
  - filter
  - cold starting system
    - fast idle cam
    - idle stop switch
    - cold idle/fast idle wax element
- electronic circuit
  - ECU (troubleshooting codes)
  - CPU
  - ROM
  - RAM

4.3.2

- PROM
- EPROM

- input data
  - sensor types
- output control systems
  - pumps
  - ignition systems
  - self diagnostic functions
  - transmission control
  - solenoids
  - actuators
  - lights
- sensors
  - crankshaft sensor
  - camshaft sensor
  - gear position
  - tip over
  - vehicle speed
  - air temperature
  - battery
  - barometric pressure
  - manifold pressure
  - coolant temperature
  - O_2 sensor
  - throttle position sensor
  - secondary throttle sensor
  - detonation sensor

4.3.3 Perform the dismantling, inspection, testing and reassembly of motorcycle electronic fuel systems.
[1/7]

- locate all components
- self-diagnostic system check
- test circuits in functioning system
- induction system checks
- fuel pressure check
- injector operation test
- bench test sensors
- diagnose simulated circuit malfunctions
- diagnostic system analyzers

4.3.4 Describe and demonstrate manufacturers' testing and maintenance procedures for motorcycle electronic fuel systems.
[1/1]

- sequential troubleshooting techniques
- electronic diagnostic flow charts
- diagnostic system analyzers
- applied safety precautions
  - eye, hand, hearing and face protection
  - high pressure fuel
  - hoists and stands
  - environmentally safe disposal of fluids
- applied tools and equipment
  - scan tools
  - multimeters
  - high pressure fuel gauge
  - synchronizing tools

Number: 4.4

Title: Carbureted Fuel Systems

Duration: 16 Total Hours Theory: 9 hours Practical: 7 hours

Prerequisites: Level 1

Co-requisites: Level 2 Reportable Subjects S0151, S0152, S0153 & S0155

Cross-Reference to Training Standards: 4134.36, 4135.0

GENERAL LEARNING OUTCOME

Demonstrate a working knowledge of all aspects of carbureted fuel systems.

LEARNING OUTCOMES

Upon successful completion, the apprentice is able to:

4.4.1 Describe the history, purpose, types and application of carbureted fuel systems.

4.4.2 Describe the construction, principles of operation and failure analysis of carbureted fuel systems.

4.4.3 Demonstrate the dismantling, inspection, testing and reassembly procedures for motorcycle carbureted fuel systems.

4.4.4 Describe the manufacturers' testing and maintenance procedures for carbureted fuel systems.

Learning Content

4.4.1 Describe the history, purpose, types and application of carbureted fuel systems. [1/0]

- air induction systems
- carburetors
- starter circuit
- pilot circuit
- low-speed circuit
- mid-range circuit
- high-speed circuit
- power jet
- accelerator/pump circuits
- air cut valve
- throttle valve operation
- air/fuel ratio management
- system diagnosis

4.4.2 Describe the construction, principles of operation and failure analysis of carbureted fuel systems. [6/0]

- humidity factors
- altitude factors
- temperature factors
- after-market modification factors
- combustion and emissions characteristics
  - stoichiometric burn
  - lean burn conditions
  - rich burn conditions
  - noxious gas emissions
  - detonation
  - pre-ignition
- effects of oil mixture on emissions (2 stroke cycle)
- advanced troubleshooting techniques for carburetion
- relationship of throttle position to carburetor circuits
- effects of individual circuit malfunctions
  - starter circuit
  - pilot circuit
  - transaction (low-speed to mid-range) circuit
  - main circuit
- relationship between active circuits and throttle position

4.4.2

- diagnosis of ancillary circuit malfunctions
  - accelerator pumps, power jet/solenoid and air cut valve
  - octane number
  - fuel energy level
  - fuel volatility

4.4.3 Demonstrate the dismantling, inspection, testing and reassembly procedures for carbureted fuel systems.
[1/7]

- diagnosis of simulated carburetor malfunctions
- fuel sub-system
  - inspect tank vent system
  - inspect fuel tank condition
  - fuel cock and mounting of tank
  - fuel cock circuits
  - servicing of filters
    - internal
    - external
  - fuel pumps
  - overhaul fuel pump assemblies
    - mechanical
    - electric
    - diaphragm
    - vane
- air induction system
  - service air filter
  - inspect ductwork for blockage
  - sealing of air box
  - correct assembly practices
- carburetor
  - overhaul practices
  - locate and identify circuits
    - failures
    - single models
    - multiple models
    - linkages and set-up procedures
  - cleaning procedures

4.4.4 Describe the manufacturers' testing and maintenance procedures for carbureted fuel systems.
[1/0]

- float/fuel level gauges
- carburetor sync gauges

4.4.4

- manometers
- applied safety precautions
  - eye, hand, hearing and face protection
  - solvents
  - environmentally safe disposal of fluids
  - hoists and stands
- applied tools and equipment
  - manufacturers' special service tools
  - precision measuring tools
  - hoists and stands
  - manometers

Number:	S0155
Title:	**Work Practices**
Duration:	33 Total Hours
	Theory: 25 hours Practical: 8 hours
Prerequisites:	Level 1
Co-requisites:	Level 2 Reportable Subjects S0151, S0152, S0153 & S0154

Evaluation & Testing:

- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the eight-week term.
- Final exam at end of term.
- Periodic quizzes.

General Learning Outcome

Upon successful completion of this reportable subject, the apprentice will be able to identify and utilize effective communication techniques and interpersonal skills, as well as be able to perform basic MIG and TIG welding techniques in accordance with government safety regulations, manufacturer's recommendations/ specifications and approved industry standards.

Number:	5.1
Title:	Communications
Duration:	20 Total Hours Theory: 20 hours Practical: 0 hours
Prerequisites:	Level 1
Co-requisites:	Level 2 Reportable Subjects S0151, S0152, S0153 & S0154

Cross-Reference to Training Standards: 4131.0, 4131.10, 4132.04, 4132.05

GENERAL LEARNING OUTCOME

Demonstrate a working knowledge of communications, customer relations and interpersonal skills.

LEARNING OUTCOMES

Upon successful completion, the apprentice is able to:

5.1.1 Describe the history, purpose, function, types and application of communications, customer relations and interpersonal skills.

5.1.2 Demonstrate an awareness of shop communications and relations in the motorcycle industry.

5.1.3 Develop an understanding of shop floor communication systems.

Learning Content

5.1.1 Describe the history, purpose, function, types and application of communications, customer relations and interpersonal skills.
[2/0]

- service attitude
- customer relations
  - professionalism
  - courtesy
- Industry relations
  - employer / employee relations
- legislation affecting workplace
  - health and safety act
- necessity of outside service
  - business awareness
- work order and customer file
- data retention systems
  - paper
  - microfiche
  - computer
- assembly and pre-delivery inspection procedures

5.1.2 Demonstrate an awareness of shop communications and relations in the motorcycle industry.
[14/0]

- service attitude
- customer relations
  - coordination of dealer/manufacturer responsibilities
  - professionalism
  - courtesy
- industry relations
  - employer / employee relations
  - OEM Technical Support
- legislation affecting workplace
  - occupational health and safety act
  - motor vehicle repair act
  - repair and storage liens act
  - WHMIS
- business awareness
  - operational costs
  - departmental efficiency
- work order and customer file

5.1.2

- data retention systems
  - paper
  - microfiche
  - computer
  - CD ROM
- technical training opportunities
  - OEM Training
  - continuing education – local colleges
  - online upgrading
- assembly and pre-delivery inspection procedures
  - safety
  - liability
  - road test
  - unit delivery
  - warranty/extended warranty/customer responsibility
  - maintenance schedules

5.1.3 Develop an understanding of shop floor communication systems. [4/0]

- complete a work order
  - internal
  - external
- outline manufacturers' warranty procedures
  - handling and tracking of warranty components
- proper usage of service manual
  - exercises
    - technical literature
    - service manuals / parts manuals
    - microfiche
    - technical bulletins
    - recalls
- service files
- completion of Pre-Delivery Inspection report
- estimates
- interpreting Department of Transportation (DOT) manual with regards to Vehicle Safety Certificate
- applied safety precautions
  - customer diplomacy
    - people skills
- applied tools and equipment
  - manufacturers' software computer requirements
  - microfiche machine

Number: 5.2

Title: MIG And TIG Welding

Duration: 13 Total Hours Theory: 5 hours Practical: 8 hours

Prerequisites: Level 1

Co-requisites: Level 2 Reportable Subjects S0151, S0152, S0153 & S01540

Cross-Reference to Training Standards: 4131.0, 4131.06

GENERAL LEARNING OUTCOME

Demonstrate a working knowledge of the construction and operating principles of MIG and TIG welding

LEARNING OUTCOMES

Upon successful completion, the apprentice is able to:

5.2.1 Define the purpose and fundamentals of metal inert gas welding.

5.2.2 Define the functions, construction, composition, types, styles and application of metal inert gas welding.

5.2.3 Explain the principle(s) of operation of metal inert gas and tungsten inert gas welding.

5.2.4 Perform metal inert gas shielded welding and diagnose weld defects, with the prescribed welding equipment.

5.2.5 Demonstrate tungsten inert gas welding

Learning Content

5.2.1 Define the purpose and fundamentals of metal inert gas welding.
[1/0]

- polarity
- power sources
- wire feeders
- gas shielding
- open circuit voltage
- closed circuit voltage

5.2.2 Define the functions, construction, composition, types, styles and application of metal inert gas welding.
[2/0]

- power sources
- rectifier
- generator
- wire types
- electrode wire coatings
- wire specifications
- shielding gases
- inner shield
- MIG welding equipment
- contact tips
- gun and cable assembly
- wire feeder types
- water cooled
- shielding gas types
- argon
- argonox
- helium
- carbon dioxide
- tungsten inert gas

5.2.3 Explain the principle(s) of operation of metal inert gas and tungsten inert gas welding.
[2/0]

- MIG Welding
  - fusion
  - metal preparation
  - equipment settings
  - arc initiations
  - gun angle and travel speeds
  - wire drive speeds
  - gas flow rate
  - electrode stick out
  - power source characteristics
- TIG Welding
  - D.C. power source
    - rectifier
    - inverter
    - generator
  - shielding inert gas
  - torch assembly
  - electrodes
  - water cooling supply

5.2.4 Perform metal inert gas shielded welding and diagnose weld defects, with the prescribed welding equipment.
[0/7]

- positional welding
- vertical up
- horizontal
- vertical down
- butt joint
- lap joint
- tee joint

5.2.5 Demonstrate tungsten inert gas welding.
[0/1]

- proper machine setup
- current control
- applied safety precautions
  - eye, hand, face, hair and clothing protection
  - respiratory protection
  - fire prevention
  - ventilation
  - flammable container welding precautions
  - electrical shock protection
  - vehicle electronics protection
  - lens filter care and selection
  - lens filter gradings
  - arch flash avoidance
  - cut and burn treatments
  - suffocation dangers
- applied tools and equipment
  - constant voltage power source
  - wire drive systems
  - gas shielding systems
  - gun and cable assemblies
  - approved welding areas or booth
  - ventilating equipment
  - vehicle electronic equipment
  - oxy-acetylene cutting equipment
  - AC, DC and combination metal arc equipment